REMARKS

The Office Action mailed September 30, 2002, has been received and reviewed. Claims 1-6 and 8-9 are currently pending in the application. Claims 1-6 and 8-9 stand rejected. Applicant respectfully requests reconsideration of the application.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent 5,883,001 to Jin et al.

Claims 1-6 and 8-9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Jin et al. (U.S. Patent 5,883,001) in view of Wilson et al. (U.S. Patent 4,943,359). Applicant respectfully traverses this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Jin discloses a two-step etching process for making a multilayer metallization structure. A metal contact 23 is formed over a region 19. A dielectric barrier 24 of SiON or silicon nitride is formed over the metal contact 23. Then, a flowable glass dielectric layer 25 is deposited over which another dielectric layer 27 is formed. A PSG layer 28 is formed on the dielectric layer 27 and a photoresist layer 30 is formed over the PSG layer 28.

To create an opening to the metal contact 23, the photoresist is patterned and an opening 26 is etched which exposes the PSG layer 28. (Jin, Figs. 4 and 5). An isotropic etch is performed through the PSG layer 28 and part of the dielectric layer 27 using 10:1 BOE. (Jin, Fig. 6, col. 7, lines 31-35). The isotropic etch creates tapered sidewalls 35, 36 on the opening 26. (Jin, col. 6, lines 37-39). Jin next discloses an anisotropic etch through the dielectric layer 27, glass dielectric layer 25 and barrier dielectric layer 24 to expose the metal contact 23. The

anisotropic etch consists of a main etch and an overetch to remove oxide residue, but which may induce charging damage to the device. (Jin, col. 7, lines 51-55).

Wilson discloses a two-step etching process for making a multilayer metallization structure. A first interconnect layer 12 is formed on a dielectric layer 11. The first interconnect layer 12 is covered by a first metal layer 13 which is then covered by a sacrificial layer 14. (Wilson, col. 3, lines 49-51). Preferably, the first interconnect layer comprises aluminum copper alloy, the first metal layer 13 comprises TiW or TiSi and sacrificial layer 14 comprises aluminum alloy or titanium nitride. (Id., col. 3, lines 53-57; col. 4, lines 4-5). The layers 12, 13, 14 are patterned and an interlayer dielectric 16 is formed thereover. (Wilson, FIG. 2). The dielectric layer 16 is patterned and dry etched to expose the sacrificial layer 14. (Id. col. 4, lines 17-24; FIG. 3). A second *isotropic* etch, preferably comprising a solution of nitric acid, phosphoric acid, and acetic acid, is then performed. (Id. col. 4, lines 34-38). The isotropic etch removes residual backsputtered material 19 and etches sacrificial layer 14 in both a downward and sideways direction to create a single "T" shaped void. (Cf. Wilson, FIGs. 3 and 4). Additionally, the wet etch chemical "removes residual backsputtered material incorporated into the polymer film" (*Id.* at lines 51-55).

Independent claims 1, 2, 5 and 6, of the presently claimed invention, each include similar limitations of an opening "extending from an upper surface of said dielectric layer to a metal-containing conductive pad" and "having substantially parallel sidewalls". Applicant respectfully submits that the proposed combination of Jin and Wilson fails to teach or suggest an opening in a dielectric layer having substantially parallel sidewalls. Instead, Jin teaches a wet etch followed by an isotropic etch and anisotropic etch to create a "Y" shaped opening. (Jin, col. 6, lines 37-39, Figs. 7 and 8). Similarly, Wilson expressly teaches a dry etch and an isotropic etch to create a "T" shaped void. (Wilson, col. 4, lines 19-21 and 34-36). As Jin and Wilson fail to teach or suggest every limitation of the presently claimed invention, applicant respectfully submits that independent claims 1, 2, 5 and 6 of the presently claimed invention, are not rendered obvious by Jin in view of Wilson. Accordingly, applicant submits that claims 1, 2, 5 and 6 are allowable over the proposed combination of references.

Applicant further respectfully submits that the process taught by Jin and Wilson would not result in a contact within a residue-free opening or a residue-free contact opening as recited by each of independent claims 1 through 6 and 8 through 9 of the presently claimed invention. While Jin discloses removing *oxide* residues from the metal contact 23, it lacks any disclosure of removing *metal* residue from the opening 26. (Jin, col. 7, lines 50-55). Thus, Jin cannot teach or suggest a "residue free opening" or "residue free contact opening" as recited in the presently claimed invention. Additionally, the Examiner acknowledges that Jin fails to teach removing metal polymer residues by applying nitric acid as specifically recited in independent claims 3, 4, 8 and 9. (Paper No. 12, page 2). Similarly, though Wilson teaches the wet isotropic etch process removes "residual backsputtered material that may have been incorporated in polymer film" (Wilson, col. 4, lines 51-52), Wilson does not teach that the wet etch chemical removes the polymer film itself.

Furthermore, the isotropic etch step in Wilson is used to substantially remove the sacrificial metal layer and create a contact interface with a wider cross section. However, the process of Wilson does not include a cleaning step following the isotropic etch. Thus, any residue created by the isotropic etch step will be left in the contact opening, compromising the performance and durability of the contact ultimately deposited therein. Applicant respectfully submits that the processes of Jin in view of Wilson will not render a contact opening residue-free, and applicant respectfully requests that the rejection of claims 1 through 6 and 8 through 9 be withdrawn.

CONCLUSION

Claims 1-6 and 8-9 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicant's undersigned attorney.

Respectfully submitted,

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